AVIATION

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The First Pursuit Group of the Air Service at Camp Skeel

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CONTENTS

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VOL. XVIII MARCH 9, 1925 No. 10

The Issues Joined

SO many assertions and denials regarding aircraft have come out of Washington during February that it has been difficult to determine just what the exact differences between airmen and others have been

The report of the Special Naval Board states the Navy's point of view and perhaps it will bring the whole controversy more definitely to the point if an effort is made to state the divergences of opinion While it would require many pages to give the supporting data for each claim, the issues of the discussion can be briefly stated in the following terms. (The pages refer to the naval report.)

Airmen assert that the mission of the Navy has been greatly changed by aircraft The Board does not give any evidence of this change either as regards naval warfare or the control of shipping (p. 8).

Airmen claim that aircraft bomb attack is directed against the bottoms of battleships where they are most vulnerable The Board asserts that aircraft bombs exploding alongside would cause "few injuries and practically no loss of life" underdecks and that "a repair party immediately after each explosion could stop the minor leaks by wooden plugs and wedges" (p 26)

Airmen claim that the only defense against air attack is by aircraft. The Board believes that "in defending a battleship against air attack, the anti-aircraft gun probably holds first place" (p 19)

Airmen declare that troops cannot be transported and landed from ships under naval protection where there is aircraft defense The Board affirms "no development of aircraft possible can take over the mission of the surface Navy, one object of which is to transport the Army, in order to break down remaining enemy resistance" (p 66, also p 6) "Aircraft attack, when met by equal aircraft or good anti-aircraft guns, will not be able to prevent the transport of troops" (p 65)).

Airmen predict that future wars will commence in the air and that by the use of gas, explosives and ground attack aircraft will paralyze military, naval and civilian activities before land and sea forces can come into action The Board, while admitting that this "might conceivably play a tremendously important part 'in Europe', air power is not so vitally important to us" (p. 16)

Airmen claim that aeronautical engineers can now produce aircraft which can carry out all the operations required for making the air force the first line of defense of any country The Board limits the increase of performance to thirty per cent (p 43)).

Airmen point to the expenditure of $433,000,000 in five years by scattered Government services without adequate results as a chief argument for establishing a Department of Aeronautics. The Board asserts that the department would require overhead expenses amounting to "many millions annually now largely avoided by the existing arrangement" (p. 68).

Airmen assert that aircraft alone with adequate equipment can sustain an offensive The Board denies this and states that an independent air offensive is essentially a raid (p 65)

Airmen assert that the British are maintaining the occupation and control of Mesopotamia by means of an air force and that other areas can be controlled similarly The Board definitely asserts that aircraft acting alone cannot occupy or control either sea or land areas

Airmen claim that a unification of procurement, operation and maintenance of aircraft would cause great savings. The Board meets this assertion with the statement that it would require a substantial duplication of the Supply Corps of the Navy (p 61).

Airmen regret that there has seemed to be meager support given to aviation development by the senior officers of the Navy The board excuses this attitude by declaring for some "fixed policy" and placing aviation "in the mind of the Navy" on a par with "submarine duty, engineering duty, ordnance duty, etc." (p. 71).

The issues are joined Let the best proof win

60% Army—40% Navy Air Service

IT has cropped out in the Congressional hearings that the Secretary of War believes that the Army Air Service should be given 60 per cent of the entire government appropriation for aviation and the Navy allowed 40 per cent. To this the Secretary of the Navy objects and on this point of difference the excellent Lassiter Report has been pigeon holed for two years.

Too great importance cannot be placed on this contention, as it leads directly to the main advantage of having a Department of Defense headed by an impartial Secretary who after due deliberation could reach a decision as to the equitable allocation of funds to the different services of the National Defense As it now stands, a deadlock has been reached and the only person in an impartial position to make a decision is the President. As the matter does not appear to have been laid before him for final determination, the whole report is left to gather dust and become obsolete through age

It would be difficult for laymen without full information to attempt to apportion the relative funds required for the Navy and Army Air Services. As it stands now, the ratio is about 50-50 With the joint utilization of fields equipment and duplicating personnel and a clear definition of functions, it is not improbable that the 60-40 ratio if advisable could be achieved on the basis of service needs rather than expenditures

Stability and Controllability of Airplanes

Part I—Longitudinal Stability and Controllability

By B. V. KORVIN-KROUKOVSKY

A vast amount of the literature has been written on the question of stability, yet when one actually begins to design an airplane, one can hardly find any practical information on the subject and after a short search of the textbooks and magazines usually has to rely on pure guess.

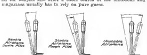


Fig. 1 Comparative movements of control stick required for increase of speed in case of statically stable and unstable airplanes

The existing literature can be readily divided in two distinct classes. The first class is formed by mathematical works of Bryant, Bairstow and their followers, and to these works we are indebted for large portion of our present knowledge of stability. However, written by mathematicians and for mathematicians, these works can hardly be mastered by the average designing engineer, both for lack of sufficient mathematical training and for lack of time. Besides, the practical use of any of their methods involves extensive and complicated wind tunnel testing of the model of each airplane to be designed, the cost of which often will be found prohibitive. The second class is formed by numerous popular articles and chapters in aeronautical textbooks. These usually suffer from being too popular, and not giving enough specific information to be of much value to the airplane designer. The majority of such papers were written during and immediately after the war, and contain good deal of information now considered obsolete. Great advance was made since the war in the science of aerodynamics, particularly in study of the aerofoils and in stability, but the information so gained is scattered in numerous technical reports, most of which are confined to some one specific aspect of the question.

Applicable to Practical Design

The aim of this paper is to present the question of stability and *controllability* of the airplane as completely as possible, making use of all scientific information available at present on this and related subjects. However, it is not proposed to make it a mere scientific discussion, but rather to give the practical and specific information which can be applied to practical design. Beside the trained engineers engaged in airplane design in large aircraft building concerns, there are many small builders modifying war time JN4's and Standards, and occasionally building entirely new machines. Undoubtedly the builders of gliders and light planes will increase in number as the time goes on. It is the ambition of the author to satisfy the needs of these airplane builders, few of whom had much of a mathematical training and most of whom are in acute need of direct and to the point answers on stability and controllability questions. It is hoped to save these men the trouble and expense of solving their difficulties by the cut and try method, or at least to give them a favorable start for such a method.

In pursuance of the scope outlined above, it was necessary to make this paper very popular and to free it from all mathematics. Care was taken to have all explanations, however popular, scientifically correct, but the proofs and demonstrations of their correctness were left out for the sake of brevity and clearness. In order not to be altogether arbitrary in his statement, the author included in the present work two Appendices giving mathematical explanation and treatment of stability and balance, on which most of the popular treatment is based. Always keeping in mind the practical application of the paper, the author arranged these appendices in such a way as to give at the end of each the final formulæ to be used in the practical work, and to demonstrate the use of these formulæ by the examples of application to the actual airplanes.

The paper is arranged in two parts, the first dealing with longitudinal stability and action of the elevator control, and the second dealing with the lateral stability and the action of ailerons and rudder. The question of airplane controllability and its relation to stability was very little touched upon in the existing literature. In the preparation of this paper particular stress has been laid on the explanation of control action and on the design of control surfaces.

Static and Dynamic Stability

Under longitudinal stability and controllability of an airplane we will consider the stability in pitching and the behavior of an airplane in regard to the elevator control. The ordinary definition of stability is that the airplane, balanced at some one throttle setting and air speed, will return to the same speed by itself after each disturbance, either due to a gust of wind or due to action of the controls. That is, if the stable airplane will be balanced at, say, 70 mi./hr. and the pilot without touching the throttle will make it dive until some higher speed, say 85 mi./hr., is reached and then let the controls loose, the machine will zoom on its own accord, and after few oscillations will balance itself again at 70 mi./hr. In the same way, if the machine will be stalled until the speed will drop to say 55 mi./hr. it will dive on its own accord until original speed of 70 mi./hr. will be regained. This tendency of the machine to return to the same speed of flight or to the same angle of glide after each disturbance is known as *Static Stability*. However, the airplane will never return to its balanced condition at once, but will oscillate few times about its speed or angle of balance, in very much the same way as a pendulum oscillates several times before regaining finally its vertical position of rest. If these oscillations of the statically stable airplane die down and the machine eventually settles at its balanced condition, it is called *dynamically stable*. If on another hand the oscillations instead of dying down increase with each beat until the machine stalls or dives, it is called *dynamically unstable*. This case is very seldom met in practice, and the machine stable statically is usually found to be stable dynamically as well.

It must be emphasized that dynamic stability or instability can be discovered only by observation of the way in which a statically stable machine pitches after returning to its condition of balance. If the machine is statically unstable it has no tendency to return to its condition of balance on its own accord, but rather tends to stall or dive. In this case evidently there will be no oscillations and the question of dynamic stability is not involved at all. The stable boat on water will roll, the unstable one will simply capsize. The remark "statically and dynamically unstable" occasionally found in test pilots' reports has therefore no meaning.

Static stability deals with the tendency of an airplane to return to its angle of attack or air speed of balance. Dynamic stability deals with the way a statically stable airplane pitches while and after returning to its angle of incidence or air speed of balance.

The conception of airplane stability or instability, although well determined in science, is not so rigorous and invariable

as we are accustomed to find in the application to other articles on the earth. In fact for most of the objects we are used to associate instability with danger. When we speak about the stability of a row boat for instance we have quite a definite idea: if it is not stable it will capsize and consequently it is not suitable for use. This kind of reasoning evidently does not apply to the airplane as many unstable airplanes were not only much used but were very popular as well. The Curtiss JN4, for instance, is unstable for most of its speed range. The Sopwith "Camel," a very popular British Scout, is also known to be unstable. It is true that an unstable machine will not fly very long with hands off, but even in stable machines the pilots do not leave the controls for long, simply because the stick is the best place to keep the hands on if not for any other reason. *The practical difference between the stable and unstable airplanes is in the way they respond to controls.*

Movements of Control Stick

The stable airplane always tends to return to its attitude of balance, i. e. it becomes nose heavy in a stall and tail heavy in a dive. The unstable machine, on the contrary, tends to depart more from its attitude of balance after each disturbance. It becomes tail heavy in a stall and nose heavy in a dive. The diagram on Fig. 1 illustrates the movements of control stick required to increase the air speed from say 70 to 85 mi./hr. without touching the throttle in case of the stable and unstable airplanes. In case of the stable machine it is sufficient to move the stick forward very little and the machine will balance itself automatically according to new position of the elevator. A rough pilot may move stick farther forward in order to get quicker effect, but he will return it for balance to the same position—slightly in front of the original one. In case of the unstable machine the pilot moves the stick forward to effect a change in the trim, but immediately has to move it back to the position *back of the original one* to counteract the tendency of the unstable airplane to take charge and to go into nose dive. Thus we see that *in a stable machine the required movements of the control stick are small and simple in their action, while in an unstable machine they are larger and more complicated*—a movement of the stick forward is necessarily followed by the larger return movement.

We will mention here the specific case of extreme instability known as *Catastrophic Instability*. Let us consider very stable and very unstable airplanes in case of a steep dive, always accompanied by high air speed. A very stable machine will require a large push on the stick to keep it in dive. If the elevator is not very effective, or if in case of a large machine the pilot is not strong enough, the machine will come out of the dive despite all of the pilot's efforts. In a very unstable machine, on the other hand, a larger and larger pull on the stick will be required as the speed of the machine increases, until the controls may prove to be not effective enough, and the machine will go in to a vertical dive or eventually turn on its back. It is an unfortunate characteristic of many unstable machines that they become very stable after turning on their back, and the effectiveness of controls may not be sufficient to overcome this stability and to right the machine. This case of instability in normal flight accompanied by excessive stability in upside down flight is termed *Catastrophic Instability*. It is rarely if ever met nowadays, but many accidents in the earlier years of aeronautics were attributed to it.

Criterion and Test of Static Stability

When a test pilot reports the airplane to be "satisfactory" or "unsatisfactory", his opinion is based on the "feel" of the controls, which in turn depends on the weight of the machine, its balance, degree of static and dynamic stability and effectiveness of controls, all of which are closely interconnected. The designer of the airplane, in order to remedy some unsatisfactory characteristics of the airplane, or incorporate in another machine some satisfactory ones, wants to have more detailed information which would allow independent analysis of each of the above mentioned properties. He can get almost all of these data if in the course of test flight the records were made of the position of the elevators and the forces on control stick at different air speeds within speed range of the machine, or even including accelerated glide (with engine running). Such measurements of the force on control stick and of angles of elevator setting were made by the staff of the National Advisory Committee for Aeronautics for Curtiss JN4H, Vought VE7 and DH4 airplanes. The results of these measurements are reproduced on Fig. 2 and Fig. 3, and are very interesting as the Vought VE7 and the DH4 are credited with good handling qualities in the

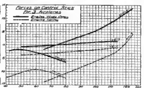


Fig. 2 Forces required on control stick of DH4, VE7 and JN4H airplanes

opinion of the pilots, and the JN4H, although not quite satisfactory according to present requirements, is nevertheless very popular and probably can be taken as the limit below which the handling qualities should not drop.

We must remember that the forward position of the stick and a push on it at high speed, or backward position and pull on it at low speed, are characteristic for stable airplanes, while the reverse takes place in the case of unstable ones. The magnitude of forces on stick or of movement of the elevators for equal deviation from the speed of balance, or speaking more generally, the slopes of the curves indicate the degree of stability possessed by the airplane under consideration. Thus from Fig. 2 we conclude that of three machines tested DH4 is most stable over the entire speed range. The Vought VE7 is slightly stable. In fact, its degree of stability, excellent for an Air Service advanced training machine, cannot be considered as sufficient for a commercial one. The Curtiss JN4H is found to be stable at speed below 50 mi./hr. and unstable above it, i. e. it is unstable for most of the speed range.

Trimming Speed Figures

The air speed of balance, usually called *trimming speed*, is indicated by the intersection of the curve of stick forces with zero line. From Fig. 2 we find that the DH4 balances at 73 mi./hr., the Vought VE7 at 77 mi./hr., and the JN4 remains nose heavy at all speed, least heaviness being indicated around 50 mi./hr. The curves for DH4 were obtained with the stabilizer set at zero angle of attack.

The curve of forces on the control stick plotted against air speed, as it was done on Fig. 2, can be readily obtained in the test flights and its slope undoubtedly represents the best criterion of stability. From the designer's point of view it still has the drawback of representing the combination of stability and efficiency of controls, rather than each one separately, and a further drawback is that it cannot be estimated during design of the airplane with any degree of certainty. The curves of the elevator setting, shown on Fig. 3 for JN4H and DH4 airplanes, on the other hand, are characteristic of stability, practically eliminating the efficiency of the controls. These curves can be predicted from the design data with fair degree of accuracy by using the methods explained in the Appendix II, and therefore provide a very good connecting link between the theoretical data used during

the design of the airplane and its flying qualities as reported from test flights. When both stick force and elevator movement curves for the airplane are available, their comparison shows the efficiency of the elevator, as well as any unusual effect such as excessive weight of the elevator or its overbalancing. Such a set of curves supplies the designer with exhaustive information as to the static stability of the airplane and the efficiency of controls, leaving only the degree of dynamic stability to the feel and judgment of the pilot

Fig 3 Elevator angles for DH4 and JN4H airplanes

We will return later in this paper to the analysis of these curves and will show how they can be used in making diagnosis as to the causes of the unsatisfactory behavior of an airplane. Before doing so, however, we will have to consider what the stability is due to and what effect different characteristics of the airplane have on it

Causes of Static Stability and Instability

The behavior of an airplane of a given weight in regard to longitudinal control is completely characterized by the degree of static stability it possesses, the degree of dynamic stability and the efficiency or peculiar properties of the elevators. Each of these characteristics must be considered and adjusted individually if a satisfactory handling machine is to be produced

Flight observations, wind tunnel tests and mathematical calculations all show that static stability depends almost solely on the position of the center of gravity of the airplane. This position is defined by three dimensions—horizontal distance from leading edge of the mean chord, vertical height with reference to the same point, and distance from the propeller thrust line measured perpendicular to it. All these distances are usually expressed in terms of the *mean aerodynamic chord*. The horizontal distance of the center of gravity from the leading edge is the most important of these three dimensions. The airplane is more stable the nearer the center of gravity is located to the leading edge. An airplane without a tailplane is in neutral equilibrium when the center of gravity is located at 25 per cent of the chord and right on it, and unstable if the center of gravity is located farther back. The center of gravity located below the leading edge of the mean chord acts as a pendulum and increases the stability, inversely, if located above the leading edge, it decreases the stability. The effect of the vertical movements of the center of gravity is, however, not very large—roughly speaking, lowering the center of gravity from six to ten per cent of the mean chord is equivalent to moving it forward one per cent

The most important and not altogether desirable effect of the vertical location of the center of gravity on stability is the variation of stability with air speed. If the center of gravity of an airplane is located on the mean chord, the airplane shows the same degree of stability at all speeds and at all angles of incidence. If the center of gravity is below the mean chord the airplane is more stable at low speed than at high speed. This is because the low position of the center of gravity produces a pendulum effect, which is most pronounced at low speed when the angles of incidence vary rapidly for a small variation of air speed. The effect of low position of the center of gravity can be explained also in another and more scientific way, by considering the horizontal distance of the center of gravity from the leading edge of mean chord. As the angle of incidence increases, the center of gravity moves forward (or wing moves backward) and this distance decreases. This of course results in increase of stability, as it was explained earlier. The majority of the airplanes at present have the center of gravity below the mean chord and display increase of static stability at low speed, which effect was heretofore erroneously attributed to the cambered tail planes

Ideal Case of Stability

The location of the center of gravity below the thrust line is beneficial to stability, location above thrust line is detrimental to it. The magnitude of this effect is directly proportional to the engine power, and inversely proportional to the weight of the airplane, as is shown in more detail in Appendix 1. The effect is not large in case of the machines of conventional design such as JN4H or Vought VE7, but it is very important in case of the flying boats. The stability added by the propeller thrust of course varies with throttle setting and disappears entirely when the engine is shut off

Thus we see that a variation in height of the center of gravity either with respect to the mean chord or to the propeller thrust line gives an effect which varies under different conditions of flight, such as high or low speed, power on or off. The ideal case then is when the center of gravity is located simultaneously on the mean chord and on the propeller thrust line and at about 25 per cent of the chord. This makes the airplane without a tailplane neutrally stable at all angles of incidence and at all air speeds, and leaves to the tailplane the provision of the proper margin of stability

The effect of the tail on static stability is not as large as it ordinarily is supposed to be, because of the small aspect ratio of the tail plane as compared to the wings, and because of its location in the downwash of the wings. In fact its total effect is just about equal to the margin of stability desirable in the complete machine, and entirely insufficient to counteract any instability produced by wings and center of gravity. This means that an airplane without a tailplane must have a neutral or very slight degree of stability, but must not be unstable. This applies essentially to the commercial passenger carrying or army bombing and observation machines, but in some cases of pursuit or advanced training machines, practically neutral stability for the complete airplane may be desirable. The Vought VE7 is good illustration of the latter case

A Valuable Approximation

The statements given above may appear startling to the reader trained on the old time conception that the airplane is inherently unstable, and that it is made stable only by the effect of the tail. For a more detailed explanation and for the proof of these statements we will refer reader to the Appendix I, in which the method of estimating airplane stability is given, together with the examples of its practical application. For the readers who do not feel qualified to go into computations as outlined in the Appendix I we will give the following rough rule for the proper location of the center of gravity required for the stability. *First place the center of gravity at 25 per cent of the mean chord. Then move it back one per cent for each 8 per cent of location below leading edge of the mean chord, or similar amount forward if the center of gravity is located above mean chord*

We must call our readers' attention to the fact that location of the center of gravity required for proper stability is the same regardless of the wing section and has nothing to do with the position of the center of pressure. Such a location of the center of gravity, of course, does not naturally produce a balanced machine, for the balance must be obtained by the setting of the stabilizer at proper negative angle of attack. The stability cannot be obtained by any other means but the proper location of the center of gravity. The balance at any one air speed, on the other hand, can readily be obtained by

the setting of the stabilizer. The understanding that it is the stability and not the balance requirements that govern the location of the center of gravity is being reached only in recent years. In most of the airplanes built in war time the designers endeavored to place the center of gravity at the center of pressure for the air speed at which the balance was desired. This resulted in the center of gravity often being located as far back as 40 per cent on the mean chord with all corresponding evils of instability, including frequent inexplicable crashes, later traced to what we know now as catastrophic instability

A detailed discussion of airplane balance is outside of the scope of this paper. As in practice, however, the balance is very closely connected with the stability, there is included in this work Appendix II, giving the method by which proper angle of stabilizer setting can be computed *after* the location of center of gravity is decided upon on basis of the data given in the Appendix I, or rough rule cited earlier in this paper

(To be continued)

An Interesting Photoplane

The little monoplane which is illustrated below was built by S W Kuhnert, an aerial photographer of Camp Hill, Pa and is used entirely for aerial photography. The main dimensions of the Photoplane are as follows. Span 30 ft. 2in., overall length 18 ft. 3 in, height 5 ft. 2 in, weight empty 300 lb., useful load 200 lb. The ship is equipped with a Lawrance 2 cylinder horizontal opposed engine and has a landing speed of 20 mi/hr and a maximum speed of 70 mi/hr. This ship can take off and land in small fields.

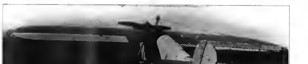
The novel thing about this plane is the fact that it was built entirely from scraps and old parts with the exception of the motor and wings. The wings are reconditioned DH9 with 5 ft chord

Mr Kuhnert's specially designed aerial camera is attached to the bottom of the fuselage in such a manner that it will photograph either oblique or vertical. This plane was first successfully test flown by Pilot Clair K Rodgers of Mechanicsburg Pa, and is now being flown by Mr Kuhnert himself

Resolutions to Protect Mitchell

Congressman F H LaGuardia, formerly Major in the Air Service, has introduced in the House two resolutions intended to prevent the demotion of General Mitchell

One orders "That no officer of the Army, Navy, or Marine Corps shall be transferred, demoted, reprimanded, disciplined, or otherwise punished on account of having testified before a committee of the House or Senate, or for having given information to any committee of the House or Senate, when such testimony was in response to questions or request for information by a standing or special committee of the House or Senate



The Kuhnert Photoplane (30 hp Lawrance A2 engine), one of the few wire-braced monoplanes in this country which was built by S W Kuhnert of Camp Hill, Pa., for his own photographic work

"Resolved further, That this Act shall take effect immediately."

The other creates in the Army an office of "Chief Flying Officer of the Army Air Service who shall also act as assistant to the Chief of the Air Service of the Army. The said Chief Flying Officer shall be selected and assigned by the Secretary of War to serve for a term of four years, and during such term shall have the rank, privileges, and pay of brigadier general of the army: *Provided,* That the first Chief Flying Officer so assigned shall have been for at least ten years a flying officer of the United States Army and have held the rank of brigadier general for at least five years next preceding such assignment, and shall have served as a flying officer of the American Expeditionary Force for at least eighteen months.

"Hereafter whenever a vacancy occurs in the assignment or position of Chief of Air Service, the Chief Flying Officer of the Army shall be assigned as such Chief of the Air Service."

Schneider Cup Race

In connection with the international seaplane race for the Schneider Cup, which will be held at Baltimore either Oct. 24 or Oct. 31, it is understood that Great Britain has already made formal entry, and both France and Italy are expected to enter by April 1, the closing date for entries

According to Maj. Wm D. Tipton, of the Baltimore Flying Club, plans will be made by that organization to enlist the widest support of all civic organizations in the forthcoming seaplane classic. The rules governing the award of the Schneider Cup provide that the country winning it three times becomes the permanent owner of the trophy. Great Britain and Italy have each won it, and in 1923 it was won by the U S Navy. Great Britain and Italy both withdrew from the race last year, the reason assigned for the withdrawal of the British entries being that the seaplanes scheduled to take part were damaged in accidents

"Aviation Day" Suggested

In order to properly commemorate Dec 17, the anniversary of man's conquest of the air by American genius, which constitutes one of the great achievements of all time, the Board of Governors of the National Aeronautic Association at a recent meeting expressed the sentiment that this date should be suitably commemorated throughout this country and adopted a resolution to the effect that the President of the United States be requested to designate Dec. 17 in each year as "Aviation Day." In this resolution the Board of Governors pledge themselves to assist in making these recurring occasions notable for emphasizing the importance of our aeronautical development to our national welfare in time of peace and our security in time of war.

Progress of Air Transport in Europe

Total Traffic of Six Years Aggregates Over 25,000 Tons

The following are extracts from a report submitted to The Assistant Secretary of War through the Chief of Air Service by an officer designated to study commercial aviation abroad who has just returned to the United States after traveling more than 6,000 mi by air over Europe.—EDITOR.

In the five years from 1919 to 1923, inclusive, European air lines have covered 13,015,800 mi—equivalent to 520 complete circuits of the world at the equator—and have transported 115,225 passengers, 1,400,000 lb of mail and 7,600,000 lb of goods. It is estimated that during 1924 an additional 4,600,000 mi was flown on regular air schedules and over 50,000 passengers transported.

Governments are showing great interest in developing commercial aeronautics and contributing liberally to its support and encouragement, in spite of the serious financial difficulties which many of the Continental nations have been facing during the years since the war.

From Africa to Finland by Air

Passengers may be booked by air, through any of the regular travel agencies, from London via Paris and Vienna to Constantinople, or via Berlin to Moscow, Russia, Helsingfors, Finland, from Paris to Copenhagen, Denmark; from Toulouse, France, to Casablanca, Morocco, in northern Africa, and on a score of other routes.

The volume of passenger traffic is increasing every year, more than 1,000 passengers a week leaving London by air for the Continent during certain seasons of the summer. The majority of these passengers out of London are American tourists and it is estimated that over 35,000 Americans visiting Europe have thus avoided crossing the channel by boat articles such as dresses, furs, jewelry, fragile goods, light machinery, etc., between London and Paris or Amsterdam are several times less by air than by boat and rail. Much gold bar and silver are shipped across the channel by air, one plane alone having carried $2,000,000 worth.

The principal investors in the national air lines of England, France, Germany and Holland are the leading industrial, shipping, banking and forwarding organizations of Europe. They are convinced that air transportation is destined to fill an important role in the economic life of the Continent. In this respect the European public is much more awake to the significance of aviation, both as an element of national defense and as a transportation agent, than is the American public.

Foreign Government Support

In addition to direct subsidy grants, considerable indirect Government support is offered to promote the growth of commercial aeronautics by the establishment of large airports at the principal cities, at which Government erected hangars and other facilities are rented to the operating companies for a nominal sum, by the free use of Government radio communications, by the development of technical appliances for commercial aviation, and in a number of other ways. In several instances municipal airports have been created at the expense of the cities as at Konigsberg, Danzig, and Rotterdam. Berlin has a big municipal landing field under preparation at Tempelhofer Field, which may be reached from the center of the city by street car in less than twenty minutes.

European nations are faced with a fundamental political difficulty in the development of air lines. In Europe the principal lines of business exchange in almost every instance

P & A Photos

A heavier-than-aircraft which is neither an airplane nor a helicopter: the La Cierva "Autogyro" which flies on rotating wings driven by the pressure of air

Valuable Goods Safer by Air

The records of European commercial air services indicate that financial matter, merchandise and freight of all kinds may often be transported by air with greater safety from loss or damage than by the usual channels of boat or rail. The insurance rates, for example, for all risks including theft, on involve flight over several countries. The United States on the other hand, is probably better suited politically to the establishment of self-supporting air lines than any other country in the world, by reason of its geographical extent, freedom from custom restrictions, common national interests and homogeneous business methods.

That air transportation has now passed the experimental stage may be seen in the amount of operating experience accumulated since the war. The aggregate number of air transport miles flown during the five years 1919-1923 is 20,110,700 mi. It is estimated that this will be increased during the present year, 1924, by 8,500,000 mi. The development of this operating experience, per year, is as follows:

TOTAL FLYING MILEAGE IN EUROPE

1919	1 085 068 miles
1920	2 204 125
1921	4 260 034
1922	5 450 053
1923	7 026 825

These figures exclude all military flying and all local or special flights, they represent only regular air transportation services over regular routes throughout the world, for which reliable statistics are available, carrying passengers, mail or commodities.

Passenger Air Traffic

As the preceding figures are an impressive measure of the accumulated amount of operating experience in air transportation, so the following statistics indicate the present traffic experience:

DEVELOPMENT OF PASSENGER AIR TRAFFIC

1919	2 585 passengers
1920	8 797 "
1921	24 224 "
1922	23 206 "
1923	62,884 "
1924	62,000 (estimate)

Thus, in the first five years a total of 121,496 passengers have been transported by air lines throughout the world.

The air mail traffic has been developed most intensively in America, where the mail carried by the Post Office Department Air Mail Service between New York and San Francisco represents the major portion of the aggregate traffic figures. In 1922 a total of 1,930,177 lb of mail were transported by air, of which 1,512,197 lb were U. S. mail over the transcontinental route. In 1923 the European air mail from France to Morocco grew rapidly in volume and of the total 2,466,279 lb carried that year, 752,009 lb represents European air mail traffic. The aggregate mail load has been increasing steadily and totals 7,144,570 lb for the five years 1919-1923, inclusive.

Freight Traffic

The recent rapid growth in the volume of air freight traffic as indicated in the following table is of special interest:

DEVELOPMENT OF FREIGHT TRAFFIC

1919	269 800 lb.
1920	476 100 "
1921	876 000 "
1922	2,348 500 "
1923	4,285 142 "
1924	5 400 000 (estimate)

Business men are beginning to learn that they can depend on air transportation for the expedition of commodities of all kinds and regular consignments of auto parts, perfumery, silks, and a hundred other articles are to be found traveling on the European airways. The fact that insurance rates are actually less by air than by boat and rail for valuable goods sent between England and the Continent has played an important part in convincing business men of the merits of the new form of transportation.

The aggregate traffic experience of air transportation lines may be appreciated if the weight of passengers, mail, and goods carried is consolidated in one figure; thus, if we allow 150 lb per passenger as a conservative figure, and include the estimates for the present year, 1924, the total traffic on the air lines for six years is: 51,277,310 lb, or over 25,000 tons.

The safety of passengers may be observed by the record of the British and Dutch air lines during the three years from 1921 to 1923, inclusive. During that time, 7,990,000 passenger miles were flown; for two years no fatal accident occurred, while in 1923 there was one accident involving three deaths. Hence the passenger air miles per passenger fatality for this period is 2,663,300.

Safety of Railroads and Airways

A comparison of this with the record of railroad lines is of interest. The New York Central Railroad, according to the last Accident Bulletin of the Interstate Commerce Commission, operated two billion eight hundred million passenger miles during the calendar year 1923, during which time 636 passengers were killed or injured. (This excludes accidents to employees, trespassers and all persons other than paying passengers). Hence the number of passenger-train miles per passenger casualty is 4,400,000. It will thus be seen that the safety record of the air lines is not far behind that of American railroads. And this has been possible in five years of development, whereas the railroads have eighty years of operation behind them.

P & A Photos

U. S. Air Mail plane equipped with a ski landing gear for winter flying which can be substituted for the regular wheel gear in 15 min

It is hard to realize that mail sent by air actually is subject to less loss or destruction than registered packages sent by train. Yet that this is so the records show without a question; thus in the three years through 1923 the U. S. Post Office Air Mail Service carried 4,316,500 lb of mail with a loss of only 230 lb.; this is five one-thousandths of one per cent, lost or destroyed.

Compare this with the percentage of registered packages carried on U. S. trains during 1922 which were lost or destroyed, namely seven one-thousandths of one per cent. There is practically no theft hazard when valuable mail or goods are sent by air and this accounts in part for the lower insurance rates which are offered by European companies for goods shipped by air.

Air Mail More Regular than Trains

It is a remarkable fact to find that the air mail service between New York and Chicago has operated for the past two years with a higher number of its scheduled trips arriving on time at destination than the average for railroad trains. The air mail planes on an 11 hr schedule between New York and Chicago, that is at a ground speed of 70 mi./hr., have arrived on time 85.8 per cent of all their scheduled trips during the period from June, 1921, to May, 1923, inclusive. This may be compared with the per cent of scheduled trains in New York State arriving on time at division terminals during 1910-1920 inclusive, namely 81.0 per cent. The average train speed from Division to Division is between 30 and 35 mi./hr., or half that of the planes.

A comparison by seasons shows that during the winter both the trains and the air mail have their greatest number of delayed trips, the trains averaging only 75.3 per cent on time, the air mail 73.0 per cent. During the spring season they are both approximately 85 per cent, but in the summer and autumn the air service is a great deal freer from delayed arrival than the railroad service, arriving during the summer 97.9 per cent and during the autumn 86.6 per cent of all its scheduled trips on time.

It is the conclusion of the report that "under suitable conditions mail and goods may now be transported by air with equal or greater safety and reliability than by train and with a great saving in time.

Helium and its Value for Airships

By PAUL W. LITCHFIELD
President, The Goodyear-Zeppelin Corporation

Helium is a non-combustible gas found in natural gas in quantities as high as approximately two per cent in volume. While there are traces of helium in all natural gas, it is now thought that the southwestern United States oil fields are the only worth-while wells so far known to exist, and by virtue of this fact the United States has a monopoly on helium.

Physically, helium is a gas lighter than air. One thousand cubic feet of helium will displace enough air to lift approximately 60 lb which is about 10 per cent less in lifting power than hydrogen, but the fact that helium is not inflammable makes it the important factor in the safety of airships. Practically all the fatalities thus far in airship development have been due to the fire hazard encountered in using hydrogen. All airship operations by other nations have been made with hydrogen since they have no helium.

Paul W. Litchfield, president of the Goodyear-Zeppelin Corporation

How Helium is Produced

The Shenandoah, the Los Angeles and all other non-rigid airships operated by the United States Army and Navy are helium filled. The semirigid airship RS-1, now being assembled at Scott Field, will use helium.

Helium is extracted from natural gas by what is called a "Squeezing Process" in the Government plant at Fort Worth, Tex. There are no privately-owned plants producing helium and there will probably be none until a sufficiently large and relatively stable market develops, presumably through the growth of commercial aeronautics. The Fort Worth plant is now operated by the Navy Department under the direction of a Helium Board made up of one representative from the Navy, one from the Army and one from the Bureau of Mines.

The natural gas from which helium is extracted is turned back into the city mains after the helium is removed, having been substantially improved in its thermal properties by the removal of the non-inflammable element.

Cost Greatly Reduced

When helium was first thought of in connection with airships, its cost was approximately $1500 per cubic foot, but the demand for comparatively large quantities has steadily decreased this cost so that helium can now be purchased for approximately $60 per 1000 cu. ft. Continued improvements in processes, with volume production, should bring the cost of helium down to perhaps as low as $30 per 1000 cu. ft.

In airship operation with hydrogen, it has been customary to discharge part of the gas through valves to compensate for variations in the weight due to the consumption of fuel. Since helium has been so much more expensive than hydrogen, valving gas is avoided through a ballast recovery device by which the fumes from the exhaust of the engine are condensed into water. Water is thus recovered in amounts actually heavier than the gasoline from which it is derived. This makes the valving of helium unnecessary. Diffusion of helium gas is small, and continued improvements of fabricated containers should render this loss negligible.

With hydrogen, too frequent replacement is necessary due to diffusion of air into the fabric gas bags. Hydrogen that contains from 12 to 15 per cent of air becomes explosive and hence it must be released into space before it reaches that point. Helium, when diffused with air, loses buoyancy in proportion to its air impurities. However, it is not dangerous and when it has become impure it may easily be re-processed and re-purified. This process would be very dangerous with hydrogen.

It may be necessary to replace hydrogen several times a year. This will not be necessary with helium.

As against the present cost of approximately $60 per 1000 cu. ft. of helium, hydrogen can be manufactured at from $3 to $10 per 1000 cu. ft., depending on the volume. Under favorable circumstances hydrogen may be procured from oxygen manufacturers as a by-product for approximately $5.00 per 1000 cu. ft. and it has been purchased by the Government for as low as $2.00 per 1000 cu. ft. However, in spite of the differential in first cost of the two gases, the Air Service is finding it actually less expensive to operate airships with helium than with hydrogen due to the factors already cited.

Helium Conservation Bill

The Eighth Annual Report of the National Advisory Committee for Aeronautics for the year 1922, estimates (p. 52) that 500,000,000 cu. ft. of helium is annually being wasted in the United States. This Committee Report unqualifiedly recommends that Congress provide for the conservation of the existing natural helium resources through the acquisition and sealing by the Government of the largest and best helium fields. House Resolution 5722 provides for the conservation of a portion of that supply and either holding this gas in its natural reservoir—the ground, until needed or extracting it for use.

This bill which is the successor of one along substantially the same lines introduced in the 67th Congress as representing the views of the War, Navy and Interior Departments, provides also for the sale or lease of surplus helium to American commercial interests, and thus opens the way for building up commercial aviation in lighter-than-aircraft, which with its natural corollaries of training of flying and ground crews, laying out of flying fields, erection of mooring masts and hangars and stimulation of the creation of manufacturing facilities, would be a line of secondary defense of no small potentiality to the nation in the event of an emergency since such ships and men and facilities would be immediately available to the military establishment.

Possibilities of Rigid Airships

The trans-Atlantic flights of the English airship R-34 and of the ZR-3, now the Los Angeles and, the four-day non-stop flight of the Zeppelin L-59 during the World War from Bulgaria to East Africa and return, indicate the possibilities of rigid airships in traveling over land and sea for long distances at high speeds.

The performance of the Shenandoah in being able to battle through a twenty-four hour storm and return safely to port despite serious breaks in the structure and the loss of two of its nineteen gas compartments when it broke away from its mooring mast at Lakehurst a year ago, is an indication of the stability of such ships. The performance of the Shenandoah in its trial flights last fall around the United States from Lakehurst to San Diego and Seattle and return under varied weather, atmospheric and topographical conditions, is likewise significant for the future.

Rapid transit of passengers, mail and express between America and Europe, between America and Hawaii and on to the Philippines, between North America and Central America and between North America and South America is possible with rigid airships. It will be possible for a man to leave New York on Saturday morning in an airship and and arrive in London Monday morning, spend four days there

on business and leave Friday morning for home and be back at his desk again Monday morning, two days for the trip over and three days for the return trip, since the prevailing winds are from West to East.

Airship Transport Abroad

A most promising start in commercial airship transportation was made in Germany before the war and it was resumed after the Armistice until restricted by the Versailles Treaty which prevents the construction and use of airships of the size large enough to be commercially successful. During this time some 35,000 passengers were carried as well as many tons of mail and express without accident or loss of life to either passengers or crew. This was done despite the fact that hydrogen was used. With helium commercial transportation by airship should be safer than any means now existing. There is little room for doubt that trans-Atlantic lines would have been running between Europe and America long since had not the war and its aftermath forestalled further commercial developments.

Prevented from further progress in Germany, the Zeppelin Corporation, whose experience has been much larger and more successful than that of any other similar group in the world, has disposed of its rights, patents and processes for North America to an American Company—The Goodyear Tire and Rubber Co. of Akron, Ohio, and there now has been organized a subsidiary corporation—The Goodyear-Zeppelin Corp.—to hold and exercise these rights.

The men who built the war and post-war zeppelins, including the Los Angeles, representing the best skilled and experienced members of the old Zeppelin building and operating organization are now in America and associated with the Goodyear Zeppelin Corp.

There are several other groups of engineers who have given this subject considerable study and who have been successful in obtaining the best airship information of England, France and Italy and it is thought that if helium gas were available these groups would be interested in beginning the construction of airships.

America's Advantageous Position

America has then the following advantages:

(1) Exclusive possession of helium—the only efficient non-inflammable gas that is available in large quantities.

(2) The best skill and experience obtainable in the world, including the experience of fifteen years of American companies in building balloons and non rigid airships.

(3) Large areas over which to travel since the Zeppelin ship is most efficient over long distances, thus supplementing the effectiveness of airplanes which operate at somewhat higher speeds but with less cruising range.

(4) Being separated by water from most of the other great nations, America has all the machinery and facilities to keep in contact with such nations in one-third the time possible by the fastest steamships. However, commercial aviation in lighter-than-aircraft depends entirely on helium.

If it were practical in every other way to operate airships with hydrogen, the psychology of the situation would retard for the present at least the development of airships in this country. It will not be possible to interest capital in the building and operation of airships if hydrogen-filled.

Sale of Helium Desired

Sale or lease of surplus helium to the American industry will open the way to a most significant and interesting development in air transportation. It should, by enabling the Fort Worth reducing plant to operate at capacity, still further reduce the cost of helium gas to the government through the ordinary economies of quantity production.

As indicating the relationship between the airplane and the airship and how each supplements the other in something of the relationship of the motor truck and the railroad, is the fact that generally as an airplane increases in size, the attendant problems increase in difficulty and the net lift or pay load diminishes while generally in the case of the airship the reverse is true. The larger the airship, the more efficient in net lift and in air maneuverability.

Working plans are now being made at Akron for a ship of 5,000,000 cu. ft. capacity, which is twice the size of either the Los Angeles or the Shenandoah. England is now building two ships of this size to connect the home land with its overseas possessions. Holland has a similar ship projected as a link with its far east possessions. Spain is now contemplating air transport to South America. America with its possession of helium has a great potential advantage over these other nations.

International Status of Airships

Before long the question will undoubtedly arise as to the international status of airships. Serious thought must be given to the question of stimulating this development in America. People who are interested in the manufacture and operation of airships have already raised the question as to whether or not legislation should be created providing that only American ships may ply in coastwise traffic or between any two American ports. The suggestion has been made that at least 50 per cent in tonnage and in numbers of all airships traveling between an American port and a foreign port should be American-built and of American registry.

H.R. Bill 5722 was introduced in the 67th Congress and referred to the Public Lands Committee which after full hearings covering four days decided it had no jurisdiction and the bill was then sent to the Military Affairs Committee which held further hearings on the measure. No action was taken at this session. It was introduced to the 68th Congress and it passed the House of Representatives on Jan. 21 with an amendment placing responsibility for the operation of the Fort Worth plant in the hands of the Navy Department rather than the Bureau of Mines as provided in the original bill.

The Senate referred this bill to the Military Affairs Committee which reported to the Senate favorably on the original bill.

BACKFIRES

Our idea of a really nasty trick is that perpetrated by the French Premier when he selected a former under-secretary of aeronautics for the post of minister of marine.

Photo Underwood & Underwood

Unique picture of a helicopter talking back at its inventor pilot

An anonymous correspondent would like to know what a stutterer should do in place of the usual "one-two-three" count before jumping with a parachute. Well, if he is up high enough he might for all the world say "Anti-aircraft artillery."

* * * *

She—"You stick to that magazine as if it were a fly paper."
He—"It is, it's AVIATION magazine."

ONE WING LOW

AIRPORTS AND AIRWAYS

Airways Information

From the Airways Section, O C A S

Maynard Field, Winston-Salem, N C, is no longer suitable for landing There is a field 2 mi south of the city which can be used An Aeronautical Bulletin on this facility will be issued at a later date.

The Washburn-Crosby Co. has erected a 500,000,000 candle-power Sperry beacon on top of its Gold Medal Flour receiving station, 200 ft. high, at Minneapolis.

The emergency field at Selma, Ala., (Aer. Bull. 142) has been abandoned. It will be several months before a new field is available

The emergency field at Little Rock, Ark., is unsuitable for landing due to hazard caused by high tension transmission lines at both ends, and *pilots are cautioned to avoid this field.*

The L shaped commercial field at Des Moines, Iowa, has been discontinued and Swaney (Emergency) Field, nearby, has been cut up into building lots; neither is available for landing. Land at Air Mail Field, 5 mi southeast of Des Moines Capitol

Emergency field at Cumberland, Md., is on longer available as tower transmission line is under construction across field. Air Service Field is in excellent condition.

Jessup Field, Lansing, Mich., has been subdivided and is on longer available for landing.

From *Notices to Aviators*·

The following information concerning landing fields for airplanes in the vicinity of Lake Washington (Puget Sound Area) has been received from the commanding officer, United States Fleet Aircraft Squadrons Battle Fleet, V. F. Squadron 2, through the Chief of the Bureau of Aeronautics and the Chief of the Bureau of Navigation·

Inglewood Golf Course.—Inglewood golf course, located on the northeastern shore of Lake Washington, at the head of the lake, is the only cleared area in this vicinity The best landing is on the sixteenth fairway, which is east and west. The approach is from the west and the lake, and there are some high trees necessitating putting the plane into a sideslip.

The fairway is smooth with a gradual uphill roll with the last 100 yd. a decided uphill slope. There is a sharp hill at the head of this fairway covered with trees. This would be a difficult field to pilot a DH plane into Drainage is excellent. The prevailing wind is usually from north and northwest. If a light wind is blowing the slope of the hill will counteract a down wind landing. Officials of the club have extended the privilege of using their course in case of emergency landings.

Approx. position 47° 45′ N., 122° 15′ W

University Golf Course—This course is located on the northern shore of the Lake Washington Canal at the lake entrance, and is easily located from the air by the buildings of the University of Washington The best landing is made by approaching from the lake, over a swamp, and putting the wheels down at the fairway. There is a small knoll on the left side of the fairway and the roll is uphill. Planes should take-off in the reverse direction from landing This course is usually crowded with golfers and landings should only be made in emergencies. The prevailing winds are from the northwest.

Approx. position: 47° 39′ N., 122° 18′ W

Municipal Golf Course.—This course is located in south-east Seattle, near the southwestern shore of Lake Washington. There is a choice of fairways to land in, depending on the wind. Fairways are generally hard, dry and fast.

Approx position: 47° 35′ N., 122° 17′ W.

Lake Ballinger.—There is a partially cleared field on the northwestern shore of Lake Ballinger, northward of Seattle and northeastward of Richmond Beach The land at the lake is marshy and the field contains stumps. A small fence borders the field on the north, high-tension wires parallel the field on the west and cross to the northeast beyond the field The prevailing wind is from the north. The only approach is from the south over the lake, putting the wheels down close to the marshy land The field is not very long and is a poor field for landing, but could be utilized in an emergency. Lake Ballinger is a good seaplane landing area.

Approx. position: 47° 48′ N., 122° 20′ W

U S Coast Survey Charts 6447, 6449, 6450 (N A 2, 1925.)

Touring Europe with Your Airplane

Probably there are many owners of airplanes in this country who have thought of the pleasures of travel abroad in their own ship An inquiry regarding the requirements that have to be met has brought to light some facts that may be of interest to those who have contemplated such a trip

One of the few persons that tried to take an airplane across with him was the late Lawrence Sperry He had to cable to England in advance for a special inspection of his ship and for a test for his own pilot's certificate. On arrival he was fortunate enough because of his world wide reputation as a flier to receive the courtesy of an inspection at the port of entry This exceptional courtesy could not be expected by others as it involved considerable trouble on the part of the civil aeronautics division of the Royal Air Force. This especial case is referred to more to bring out the difficulties than to give the impression that the same procedure could be followed by anyone else.

Until there is some national regulatory law in this country by which there can be an exchange of courtesies, it cannot be expected that there is hope of a change in the conditions now prevailing. Aerial tourists who are planning to make the "Grand Tour" by their own airplane are warned that the difficulties to be overcome are so great that the advantages would not make up for the inconveniences.

Curtiss Active in South America

Orton Hoover, who has spent the last six years in Brazil as the representative and resident manager of the Curtiss Aeroplane Export Corp. of 52 Vanderbilt Ave., New York, has just been "loaned" by this Company to the State of Sao Paulo for the purpose of re-organizing and re-equipping the Sao Paulo State Air Service known as the Força Publica. Mr. Hoover and the Curtiss Company originally organized this air service a number of years ago, but it was later taken over by the federal government. Mr Hoover's contract with the State of Sao Paulo covers a two year period.

Huff Daland planes have already been ordered as instruction machines for the new service.

The Argentine Army Air Service, through Lawrence Leon, resident manager for the Curtiss Aeroplane Export Corp in the Argentine, has just closed a contract with this Corporation for ten training planes. Half of these ships will be equipped with OX5 motors and the other half with Curtiss C6 motors.

Caution to Pilots

A smoke stack approximately 80 ft. high has just been erected at the Post Machine Shop at Langley Field, Hampton, Va. This stack, during darkness, will always be marked plainly by an incandescent light at the top. The Commanding Officer of Langley Field desires that this matter be brought to the attention of all pilots who might be likely to visit Langley Field.

A Successful West Virginia Firm

The Shank-McMullen Aircraft Co of Huntington, W Va., was organized by Bob Shank and A. B. McMullen "The Flying Farmer" in the fall of 1922. Since its organization the company has enjoyed a steady and continuous growth until it is now the largest company of its kind in the state and

International Newsreel Photo

Curtiss PW8's of the First Pursuit Group Air Service lined up for inspection at Selfridge Field, Mount Clemens, Mich., preparatory to the recent maneuvers

one of the largest in the East Its growth is no doubt partly due to the fact that both of the organizers were experienced in all lines of aeronautics and knew what kind of service an aircraft company should give

Bob Shank learned to fly in 1913. He first worked as a mechanic for Eddie Stinson who was at that time engaged in building some of his first planes, and there got the idea of building a plane for himself which he did, and if we can believe the stories Bob now tells about landing in and taking off from ball parks and back yards it was all that could be wished for in the way of a fast climbing, slow landing plane

Without any instruction Bob took the air and, although he will not admit it, must have cut some awful 'di does' for Stinson immediately took charge of affairs and told him to bring the plane over to his field the next day and he would teach him to fly before he broke his neck. For a total of ninety minutes Stinson instructed Bob in the art of modern flying and then pronounced him a finished flier

Within a few days time he was filling exhibition dates all over the country, which he continued until the outbreak of the World War, when he was employed by the Government as a civilian flying instructor at Kelly Field. Later he was transferred to Love Field, and when the Air Mail was inaugurated in 1918 he was one of the first four pilots to fly a regular schedule As the other three pilots have folded their material wings and departed to the great beyond, Bob now rightly claims to be the oldest mail pilot now living

After approximately a year's service with the Mail he resigned and began barnstorming which he followed until 1920 when he located permanently in Huntington, only a few miles from where he was born.

A B. McMullen enlisted in the Artillery at the outbreak of the World War, but soon decided that if he was going to see much of the big show he would have to get higher than a battery observation tower So, at the first opportunity, he applied for a transfer to the Air Service During the latter part of 1917 the transfer came through and after nine weeks at ground school at the University of California he found himself at Rockwell Field a full fledged flying cadet

Space prevents a description of the ups and downs (per-pansies) for the following few weeks. Suffice to say that he emerged with shining wings and bars, and promptly received orders to report to the newly organized Gosport instructors school at Brooks Field. Upon completion of this course of training he was ordered to Call Field as a flying instructor and after a short stay there was transferred to Souther Field, where he served for nineteen months as flying instructor and officer in charge of motor and aero repair At the time of his discharge he was post engineer officer

While stationed at Souther Field, Ga., McMullen purchased a large cotton plantation a few miles from the field and kept tab on his negro farm hands by making occasional reconnaissance flights over the place The rapidity with which the approach to the plantation could be made by air compelled the shirking negroes to keep in the field during working hours, for they could not watch for the approach of the plane and then slip out of the back door and into a nearby field as they were accustomed to do with the old overseer who made his rounds on horse back. It was for this reason that Mac was dubbed "The Flying Farmer".

He resigned from the Army in the spring of 1920 with the intention of devoting his entire time to the plantation but three months without a loop or vertical bank caused the farm to lose its proprietor "Mac" purchased a Canuck and struck out through the states of Georgia and Florida. During the following two years he pushed the old Canuck over parts of every Southern and Central state east of the Mississippi In the fall of 1922 a contract with the Huntington Tri State Fair brought him to Huntington and it was then that he met Shank and the present company was formed.

Students and planes of the Shank-McMullen Airways, Inc., lined up on the company's flying field at Huntington

During the past eighteen months the above company has sold twenty-six flying boats and planes of different types, taught thirty-one students to fly, carried 1350 passengers, successfully completed numerous advertising and photography projects while its planes have flown approximately 25,000 mi. A growing airplane repair and supply business has also been built up

Owing to a transposition of caption of lower illustration in a previous issue we are showing this illustration again

UNITED STATES AIR FORCES

U. S. ARMY AIR SERVICE

Curing Deafness by Airplane Flight

Much interest was manifested in the attempts to restore the hearing of Joseph Kling by an airplane flight at Mitchel Field, L. I., New York. Mr Kling's case is still under observation and, while he reports a slight improvement, nothing conclusive has been accomplished

An important step in this experiment has been to acquaint the public with just what types of deafness are susceptible to the airplane treatment Prior to the experiments with Mr. Kling, the belief prevailed that an airplane flight would cure any type of these afflictions. By the hopeful it was considered a form of miracle cure and by others a form of quackery. Today, in the vicinity of New York at least, the general public knows that no relief from this direction can be expected where the affliction is of an organic nature. An airplane ride is of no more value than a ride in a wheel-barrow if it is a question of the disease or destruction of an organ of speech or hearing.

When the affliction is of an emotional nature and the result of shock, it is possible and reasonable to suppose that another shock, if accompanied by faith, may effect a cure. It is believed that this information has relieved many troubled minds and even proved illuminating to some members of the medical profession

News Notes from Aberdeen Proving Grounds

Inclement weather greatly hindered the Ordnance bombing programs for the month of January The greater part of the programs call for the bombs to be dropped from altitudes of from eight to sixteen thousand feet. Due to very poor visibility, only a very few of the programs were carried out. Several tests of the MKI Airway parachute flares, dropped from 4,000 and 6,000 ft., were made and proved to be very satisfactory, the flares giving a very bright light for approximately three minutes. Several tests were also made with the MKIII reconditioned flare which proved to be successful. These flares give a very brilliant light for approximately seven minutes.

The supercharger De Haviland airplane, which was brought to Aberdeen from Fairfield to be used in high altitude bombing tests, is being returned to the Fairfield Air Intermediate Depot to undergo certain changes which will make it possible to carry a 300-lb. bomb under the center section. At present, the underslung radiators and the brace wires in the undercarriage are in such a position as to warrant a change before bombing can be done.

Seifert Quits Air Service

Failure to see any bright future for junior officers of the Air Service under the present system, has caused Lieut. Frank Seifert, who gained distinction in the summer of 1923 by piloting one of the planes during the mid-air refueling tests at Rockwell Field, when eight world's flight records were broken, to resign from the Air Service.

Most of the outstanding achievements of the air have been conceived and executed by the pilots themselves, the resigning Lieutenant stated

"The transcontinental flight of Kelly and Macready was conceived by these two men," says Lieutenant Seifert. "Smith and Richter should be given credit for the mid-air refueling exploit, and Eric Nelson and Lowell Smith were in the main responsible for initiating the world flight project and seeing it through to a successful conclusion."

Lieutenant Seifert leaves the Air Service with a record of 1,000 flying hours without an accident.

Air Service Casualties

Sec. Lieut. Duane G Warner, attached for duty with the 27th Pursuit Squadron, died at Saint Josephs Sanitarium in Mount Clemens, Mich, Friday, Jan. 23, from injuries received when his plane, a Curtiss Pursuit PW8, crashed on the ice of Lake St. Clair on Jan 19.

Lieutenant Warner was born in Hampton, Conn., March 8, 1899 He enlisted as a private Oct. 8, 1918, and on Oct. 7, 1921, was sent as a cadet to Carlstrom Field, Fla, for training He graduated April 17, 1922, and was sent to the First Pursuit Group, then at Ellington Field, for advance training Lieutenant Warner graduated as a pursuit pilot on Dec. 21 of that year, and on July 5, 1924, was commissioned a Second Lieutenant and assigned to the First Pursuit Group at Selfridge Field

Lieutenant Warner loved to fly and, at the time of his death had 674 hr flying time to his credit.

* * *

Maj Lee O Wright of Lyons, Ind, and Lieut. Arthur L. Foster, whose parents live at Weir, Tex., were instantly killed and their bodies burned in an airplane crash near Brooks Field, San Antonio, Tex, on Feb 10

The plane went into a spin at 500 ft. and crashed within two miles of the field.

Major Wright, an ordnance officer, was a student and Lieutenant Foster was his instructor

World Fliers Bill Passes House

The House of Representatives passed on Feb 16 the bill to reward the six Army aviators who made the round-the-world flight With President Coolidge's approval Secretary Weeks has personally urged Congress to act on the measure at the present session

The President does not think the reward proposed is altogether adequate, but he nevertheless approved the recommendations made by the Secretary of War and sent them to Congress with a request for early action.

The measure, sponsored by Representative Hill, Republican of Maryland carries a promotion of 1,000 files for Lieutenant Smith, commander of the squadron

Lieutenants Nelson and Wade would receive a promotion of 500 files each, and Lieutenants Ogden, Harding and Arnold, permanent commissions as second lieutenants. The latter three served under reserve commissions during the flight.

All members of the squadron would obtain the Distinguished Service Medal and permission to receive decorations from foreign nations.

A provision to permit the fliers to retire from the service at their discretion was eliminated from the bill

What Vibration Will Do

During a recent flight from Langley Field, Va., to Chanute Field, Ill., where they ferried students to the Air Service Technical School, Lieut. G F Rodgers, pilot, encountered considerable hard luck, owing to very inclement weather and motor trouble. While flying from Moundsville to Columbus, Ohio, the pet-cock on the water pump opened through vibration, causing the water to run out and burn out the motor, so that they were forced to land at Reynoldsville, Ohio.

Staff Sergeant Coulston accompanied Lieutenant Rodgers as mechanic.

Kelly Field Officers Change Stations

A number of officers departed from Kelly Field recently, including Capt. Lester T. Miller and Lieuts. Kenneth McGregor and Philip Schoeneberger for Hawaii; Lieut. W T Larson for Panama, and Lieut. James G. Fry for the 2nd Division, Fort Sam Houston, Tex.

A Brave Deed

While returning to Mitchel Field, N Y, from Watertown, N Y, recently, Sergt. Samuel H Turner, 1st Observation Squadron, encountered motor trouble over Croton-on Hudson, N Y., and for want of a landing field was compelled to land in the icy waters of the Hudson River. The thermometer was near the zero point and a northwest gale was raging. Stunned by a blow he had received on the forehead when his plane hit the water and weighed down by his water-logged flying suit, Sergeant Turner, although only one hundred feet from the shore, was completely marooned

Efforts to reach him with a rope or to secure a boat failed and the handful of spectators on the beach watched him in grim silence as he was slowly freezing to death Aniello Conti, a cook for the N Y. Central R. R., and employed nearby, arrived on the scene, and without hesitation he braved the treacherous mud and chilling waters of the Hudson and brought Sergeant Turner ashore, the latter by this time being in a state approximating collapse. The following day Sergeant Turner had so far recovered from the shock and exposure as to be released from the hospital at Croton.

In risking the cold, the mud and the strong current of the Hudson River, Mitchel Field feels that Mr Conti risked his life for a member of the garrison and accordingly, he has been recommended for a Carnegie Hero Medal.

U. S. NAVAL AVIATION

The Los Angeles Trip to Bermuda

The U S airship Los Angeles left Lakehurst at 3 40 p m on Feb. 20 for Bermuda carrying the first international air mail to leave this country The ship was under the command of Capt. George W Steele and carried an all-American crew. She carried as passengers Assistant Secretary of the Navy, Douglas Robinson, Rear Admiral W. A. Moffett, Chief of the Naval Bureau of Aeronautics, Capt L. E Lyons of the same bureau and Capt. Robert Ghormley, aide to Secretary Robinson About 200 lb of mail were carried including 2,200 letters, 138 postcards and three registered letters from New York City

The outward voyage was uneventful and Hamilton, Bermuda, was sighted at 4 45 a. m on the 21st. It was intended to moor at the mast on the Patoka. On arrival at Hamilton it was found that the Patoka was in the Harbor at Hamilton and she was requested by radio to move out into Great Sound. Shortly after the arrival of the Los Angeles a tropical rainstorm broke out and after cruising around for several hours the outer skin of the airship collected several tons of water A consultation was held on board and Captain Steele decided that it was unwise to moor Accordingly, the alternative plan of merely paying an aerial visit was carried out. The mail bags were dropped in front of the Government House and the ship's head was turned toward home at 9 05 a. m.

Both during the flight out and the flight back the radio compass on board and the compass stations on shore were a great help in navigating the ship A great deal of the time the sky was overcast, making it impossible to take observations despite this condition they picked up the light at Bermuda dead ahead. It is planned to repeat this flight in the near future

Skillful Balloon Piloting

By skillful piloting a free balloon of the Naval Air Station, at Lakehurst, N. J, was able to return to almost the exact spot from which it left after a flight of nearly eight hours several days ago Winds from nearly every point of the compass were called into service to enable the pilot of the balloon to accomplish this unusual feat. With no motive power of its own, the balloon was made to follow a course roughly resembling a square, with a distance of 65 mi. to the side. The return to the landing field at Lakehurst was possible because of the skillful work of the pilot in changing altitude to reach favorable wind conditions. The balloon was lowered by allowing the inflating gas to escape through a valve and was sent up by throwing overboard ballast, thus lightening it.

The recent eight hour flight made at Lakehurst that terminated near the starting point, was made with student aviation officers as passengers. This type of craft is used to train Navy officers in the fundamentals of traveling in lighter than air craft, as a preliminary to work on the two large rigid airships, the U.S.S. Shenandoah and the Los Angeles. By the use of free balloons the officers obtain a first hand acquaintance with the characteristics of wind and temperature as affecting lighter than air craft, and become familiar with the effect of releasing gas and dropping ballast. These two methods of ascending and descending are employed on the large airships with the same effects as with a free balloon.

The Shenandoah's Cook Stove

An aerial cook stove of special design will be installed on the Navy's rigid airship Shenandoah, for use in future operations This stove is operated by electricity and has thermostatic control in each of its three ovens. Designed for use in an airship, where weight and size are important considerations, the stove weighs but 219 lb complete with its utensils. Only four feet long, its height is two and one half feet, and its breadth is two feet. The current is capable of heating the stove to 450 deg. Fahr. when the outside temperature is down to zero To keep this heat within the oven, one inch thick walls of special insulating material compressed to a density of 15 lb./cu. ft., are provided around the ovens. The current is furnished by a 220 volt radio generator, run by a small gasoline engine. An automatic cut-off is provided which cuts off the current to the stove when the radio, which requires all the power available, is being used

With this stove the crew of the Shenandoah may look forward to eating meals while a mile in the air, fully the equal of their regular fare on the ground. Before this stove was designed, coffee heated over the engine exhausts constituted the only hot article of diet on their menu.

Naval Air Orders

Comdr John Rodgers, det. Nav Air Sta., Pearl Harbor, T H, to Aircraft Squadrons, Sctg Flt

Lt. Comdr Millington B McComb, det. Aircraft Squadrons, Battle Flt., to Naval Air Station, Pearl Harbor, T H

Lieut. Thomas B Lee, det Aircraft Squads., Sctg Flt; to Aircraft Squads., Battle Fleet.

Lieut. Samuel Chiles, det, Nav Air Sta., Anacostia, D C; to Naval Ord Plant, So Charleston, W Va.

Lieut. Robert H. Lake (CC), ors. Jan. 15, 1925, to Navy Yard, Phila., Pa., revoked Det Nav Air Sta, Anacostia, D C, to continue treatment Nav Hosp, Wash, D. C.

Lt. (jg) William C Gray, det Nav Air Sta., Pensacola, Fla., to U S S Humphreys

Lieut Daniel W Tomlinson, upon expiration leave absence; det. Naval Academy, to temp duty, Nav Air Sta., San Diego, Calif, upon return of Aircraft Sqds, Battle Flt., to Pacific Coast, to duty involving flying

Lieut. Albert S Marley, det. Aircraft Sqds, Battle Flt; to Naval Air Station, San Diego, Cal

Lakehurst News

Repairs and overhaul of Shenandoah are progressing slowly while she is awaiting helium The engine cars are all in place and the ship has the appearance of being ready to fly, except for the replacement of fabric along the keel

The 2 KW tube transmitter, designed and built at the Radio Research Laboratory at Bellevue, D C, together with the power unit supplied by the Kinney Mfg Co., has been assembled and successfully tested This set will be installed at once.

Lieut. W. S. Garrett Killed

Lieut. W S. Garrett, U.S.N, was burned to death at Yuma, Ariz., Feb. 18, when the plane which he was piloting sideswiped on the edge of the field and crashed to earth from an elevation of 100 ft.

The machine burst into flames, severely burning the observer mechanic, J. Funk.

Lieutenant Garrett was stationed at the naval air station at San Diego, Calif

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